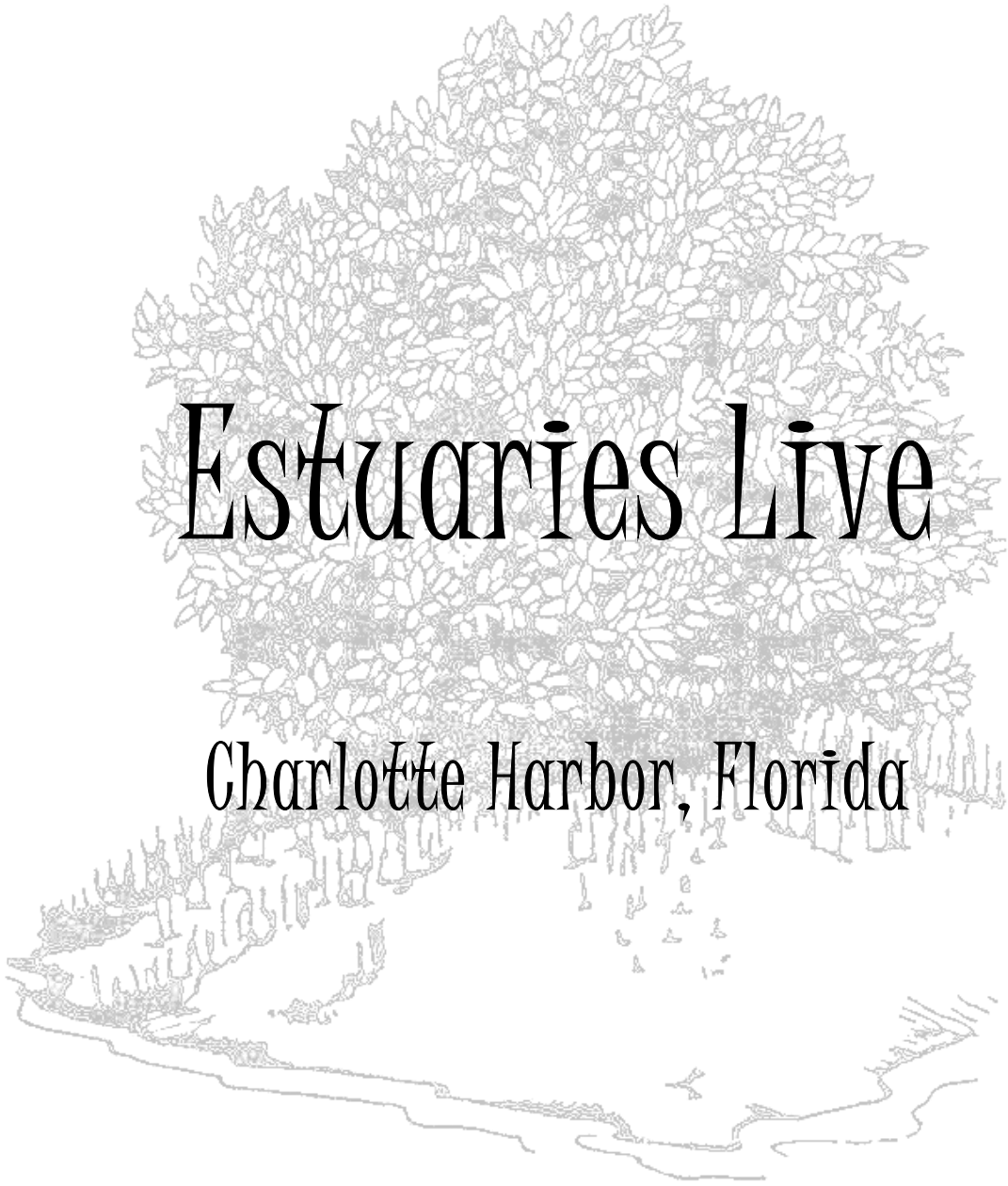
Estuaries Live

Charlotte Harbor, Florida



Mangrove Communities of Southwest Florida: A Brief Overview

(Adapted from Rookery Bay National Estuarine Research Reserve Marine Science Curriculum Manual, 1990)

The term mangrove can refer to a species of tree or to a forest community. There are approximately fifty mangrove species worldwide, which generally are found between 25 degrees north and 25 degrees south latitude. They are not necessarily phylogenetically related.

Mangroves are defined in several ways.

1. They are halophytes (salt tolerant).
2. They tend to grow in loose soil and display some root modification capabilities.
3. They depend on tidal flux to disperse propagules (seedlings).
4. They display some degree of viviparity (seeds sprout on tree).

In south Florida, mangroves are the dominant saltwater wetland vegetation. The red mangrove, *Rhizophora mangle*, tends to dominate overwash islands, fringe forest, riverine forests and dwarf forests. The black mangrove, *Avicennia germinans*, dominate the basin forests. The white mangrove, *Laguncularia racemosa*, is found mixed with other mangroves and usually inhabits the high back berms. The buttonwood, *Conocarpus erecta* is not a true mangrove species but is found in the mangrove community. The values of mangroves are based on their many functions in the environment. These include, but are not limited to:

erosion prevention,
inland protection from the destructive energies of storms,
supplying nutrients for seagrass beds,
filtering of storm water run off,
production of peat soils,
nesting habitats for birds,
creation of substrate for epifauna,
protection of juvenile organisms and
support of detrital food web.

Semantic Map About Mangroves

In this activity students will recall information they already know about mangroves and develop questions for future study during the unit. A semantic map will be developed and enhanced as students gain new information. An example of a semantic map developed about sharks, both before and after additional study, is provided on the next page.

The research questions generated during this activity will become topics for additional research and study.

Materials

- Poster board or chart paper
- Transparency markers
- Post-it notes

Procedure

1. Write the word mangroves on the center of a large sheet of poster board or chart paper
2. Distribute packets of Post-it notes to student groups (4-5 students per group).
3. Working as a group, ask the students to think of as many words and ideas as they can that relate to mangroves. Tell them to write these words on their post-it notes (one word per post-it).
4. Take turns having students from each group place their post-it notes on the poster board until there are no new ideas offered.
5. Work with the students to place their words into categories related to mangroves.
6. Ask students to suggest categories and add them to the map. Examples of semantic maps developed about sharks both before and after additional study are provided on page 11.
7. Based on the map, ask students to suggest research topics the class might investigate about mangroves. For instance, if students have volunteered the idea that mangroves grow in salty water, a research question might be "How do mangroves trees thrive in salt water when other trees cannot?".
8. List the suggested research topics on another poster board or on an overhead transparency.
9. Tell students they will return to this map and to the research questions later in their studies of mangroves.
10. Be sure to return to the map and the question list throughout the days of studying mangroves. Support students in investigating the research topics,

either as individual study, such as science fair projects, or as class investigations.

Evaluation

When the research projects have been completed have each student create a new semantic map about mangroves. Encourage students to include all they have learned. Review the semantic maps and return them to students. Have students return to their original groups and create a group semantic map by sharing all their information. Have the groups show their semantic maps to the class and encourage discussion. Display all the group maps in the classroom.

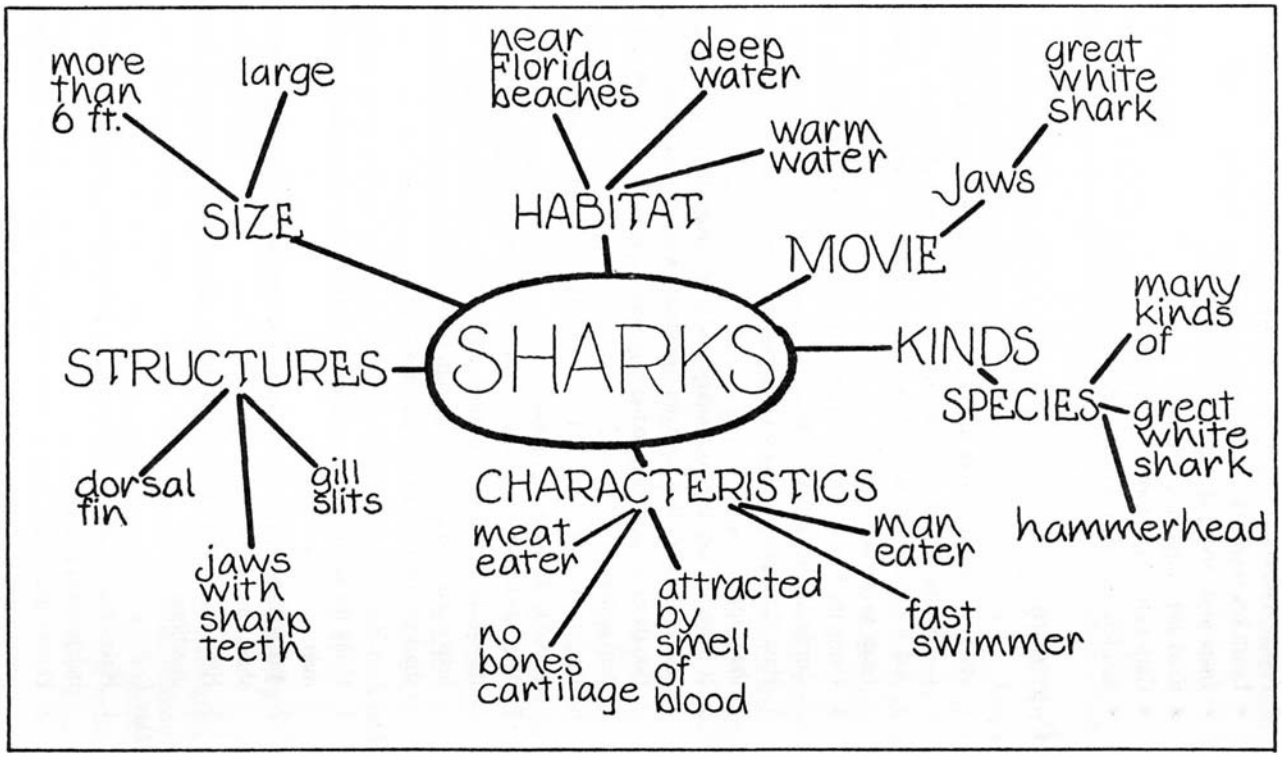


Figure 12
Initial Classroom Map for *Sharks*

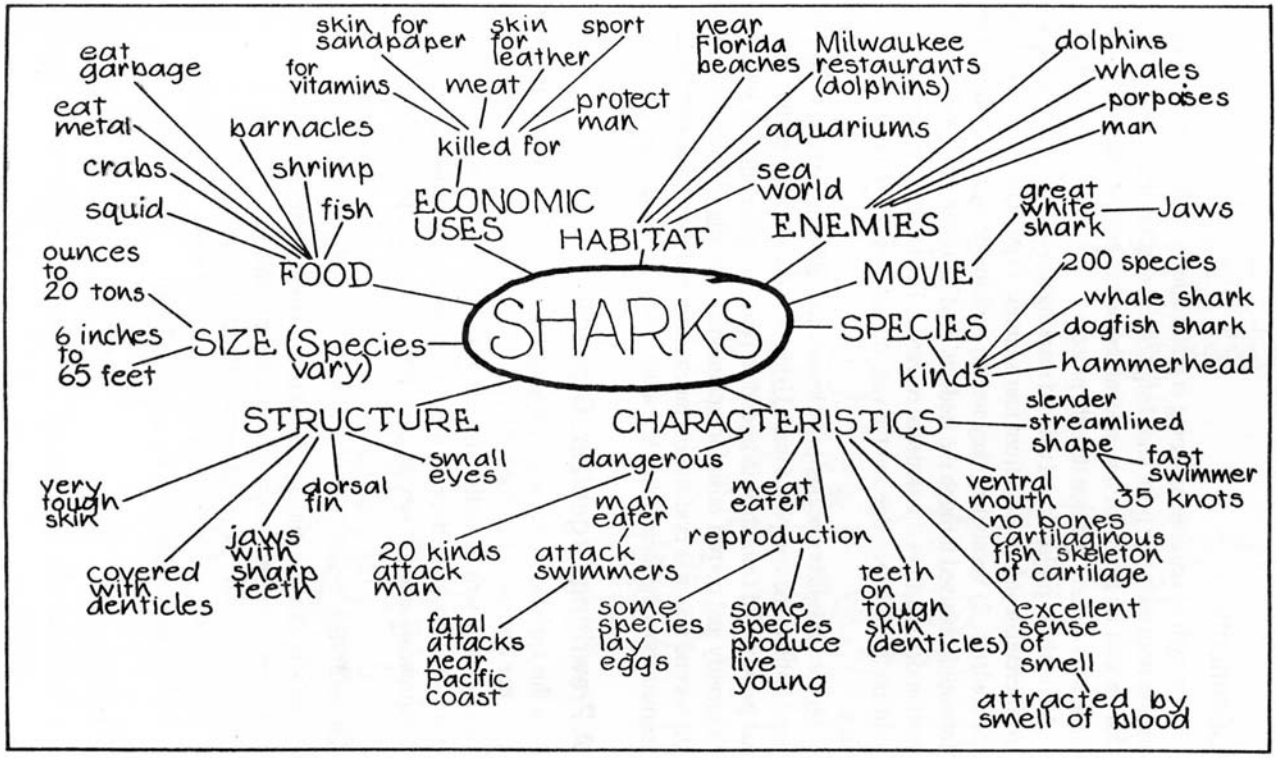


Figure 13
Completed Classroom Map for *Sharks*

Source: Semantic Mapping: Classroom Applications. Joan E. Heimlich and Susan Pittelman. 1986.

"Seeding" Mangroves

In this activity, students will read descriptive text about mangroves and engage in group discussions about the reading.

Materials

- One copy for each student of *Mangroves* by Lynn Stone (pages 18-19).

Procedure

1. Copy and distribute to each student a copy of the text excerpted from *Mangroves* by Lynn Stone which was published in Florida Wildlife Magazine in 1982.
2. Tell students that after reading the text they will be discussing the material with their peers. To assist their learning and understanding of the text they will utilize discussion "seeds". "Seeds" will allow them to increase their reading skills and their understandings of mangroves.
3. Together with the students make a list of possibilities for discussion seeds and show them on an overhead transparency, chart paper or on the white / chalk board. Some good seeds are:

   questions about material I don't understand

   comments about things I've learned

   things that are interesting or surprising

   vocabulary that is new

   writing that was enjoyed

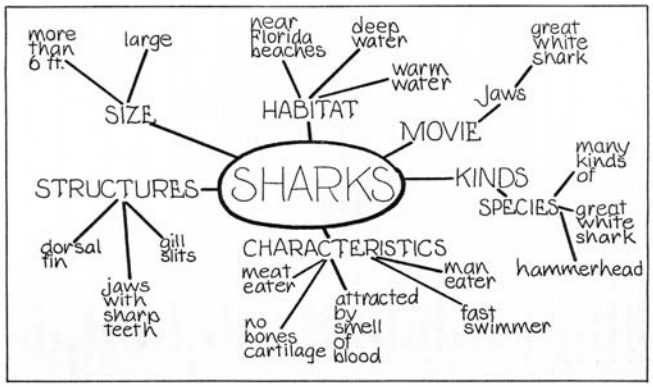
   writing that reminded me of other reading I've done

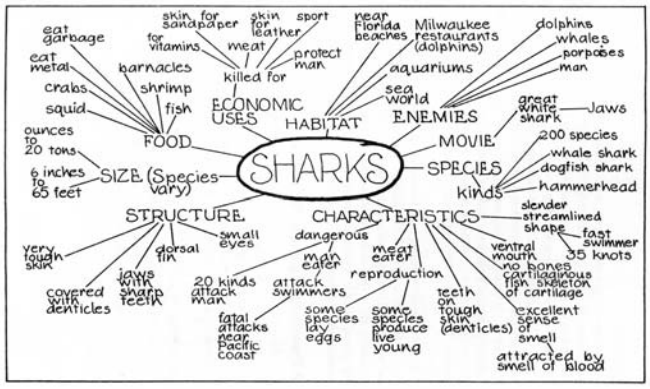
   places I have visited that are similar or different

4. Read aloud several paragraphs from the *Mangroves* text and use an appropriate discussion seed to lead a whole group discussion.
5. Divide the students into groups of 4-5 and ask them to use the discussion seeds established by the class to review the reading material.
6. Depending upon the reading level and/or age of the students you may assign the entire selection or divide the passages and assign student groups specific passages to read and discuss. This activity can also be assigned as a

homework assignment. If given as a homework assignment, make sure there is a good discussion of vocabulary before the article is sent home.

7. Tell students they will be responsible for reporting on their discussions and sharing with the entire class.
8. Give the students a time limit for their discussions.
9. Assign roles to each person in the group. For instance, one person could be sure that every person in the group provides input on at least one seed, one person could record all the questions the group had, one person could record all the vocabulary that was new, one person could communicate the questions to the entire class and one could communicate the vocabulary.
10. Allow each group time to report on their work.
11. If this activity is used in conjunction with a semantic map at the beginning of mangrove study, add new information to the original semantic map and new questions to the list of research topics.





Excerpted from *Mangroves* by Lynn M. Stone, Florida Wildlife, November-December 1984.

A bumper sticker on a Ford pickup in Sarasota was emblazoned "Support Your Local Mangroves." Sage advice, that bumper sticker, because Florida's mangrove trees are in many ways responsible for south Florida's abundance of fish and wildlife.

Bushy red mangroves and their ecological kin, white mangroves and black mangroves are unusual, for unlike most terrestrial plants, they are salt-tolerant. Approximately 90 percent of commercial fish species and 75 percent of gamefish species – including bonefish, gray snapper, permit, redfish, snook, tarpon and seatrout - are linked to mangrove food chains.

Most of the animals, which prosper from the mangroves, do not directly consume the leaves, twigs, bark and seedlings. The full energy potential of the trees is not reached until the mangrove material has been broken down by bacteria and fungi. Then the nutritional benefits work their way through the food chains.

Tiny invertebrates, which feed on microorganisms that cluster on mangrove particles, are devoured by larger animals. Eventually, energy stored in mangrove trees reaches predators at the top of the food chains: wading birds, crocodilians, raptors, large fish and other higher animals.

Characterized by jumbled support roots, which hold the trunks of mature trees above most high tides, red mangroves are hardy and fast growing. They form islands and fringe estuaries, the richest of the mangrove environments.

Everywhere they grow, mangroves reproduce efficiently. A mature tree produces dozens of green, panatella-shaped seedlings, which germinate on the branches. Some of the seedlings root where they fall, gradually increasing the size of the colony; others float away on currents. Sooner or later, often many miles from the parent tree, seedlings may beach and take root, beginning a new colony.

Green mangrove forests look pleasant enough against a blue canvas of ocean and sky, but visitors beware! The beckoning mangrove islands are "bewitching." As Columbus noted on his first voyage to the New World, the mangroves were "so thick a cat couldn't get ashore."

In addition to being basic food for coastal and estuarine ecosystems, mangroves provide roots and nesting sites for many spectacular Florida birds. Each spring, a few select islands in Florida bays attract a crowd of nesting double-crested cormorants, brown pelicans, herons, egrets, wood storks and white ibises. Despite the chaos of territorial squabbles, punctuated by the croaks, grunts and rasps of young birds, the species coexist and raise new generations. Less conspicuously, the black-whiskered vireos, mangrove cuckoos, Florida prairie warblers and gray kingbirds also nest in the mangroves.

Many birds feed on exposed bay bottoms near the mangroves. At low tide, white ibises use their curved bills to probe the mud for crustaceans. Spoonbills use their mandibles to strain shallow water for tiny animals as they stride past motionless, great blue herons and

American egrets, which have staked out deeper pools. Shore birds, jabbing and plucking, bustle across the flats. Nearby, where dark submerged carpets of turtle grass hide blue crabs, sea urchins and snails, red-breasted mergansers plunge into quick silver minnows; and white pelicans, winter residents of the bays, encircle schools of fish. Overhead, ospreys scan the bay for sea trout.

With the exception of a few bird species, most large animals avoid mangrove forest or are merely passers-by. Even the so-called mangrove fox squirrel of south Florida prefers pine and cypress. Key deer, white tails of the lower Florida Keys, occasionally browse on mangrove leaves. Now and then otters, bobcats, marsh rabbits, opossum, corn snakes and mangrove water snakes turn up. Manatees sometimes roll by mangrove stands.

The only mammals that really thrive in mangroves are raccoons. Of course, raccoons can adapt to almost every Florida habitat. They are fine climbers and swimmers, and they often shuttle to mangrove islands far offshore.

Favorite morsels of raccoons include 'coon oysters, one of many types of invertebrates that colonize roots of red mangroves. Flooded daily by tides, their roots often bulge with clusters of barnacles, hydrozoans, tunicates, sponges, algae and even coral.

One of the least-known creatures of the mangrove community in south Florida is the endangered American crocodile. These reptiles have their last American stronghold in the mangrove-rimmed fingers and coves of Florida.

American crocodiles inhabit only salt water or brackish water, but other crocodile species around the world inhabit fresh water.

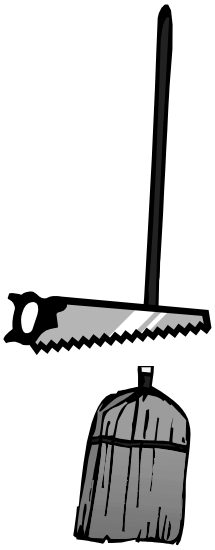
As public awareness continues, more interest is being shown in protecting the mangroves and life forms, which live in association with them. These valuable ecological systems can continue to be one of the state's most productive nurseries of life if they are maintained in a healthy state.

Build a Red Mangrove

This teacher demonstration will introduce students to unique properties of the red mangrove tree. It will engage student interest in the topic particularly if the teacher "hams it up".

Background Information (Also, review page 9 about Mangrove Communities)
Red mangroves have leathery leaves, prop roots and cigar-shaped propagules. The propagules may fall from the tree and lodge into the soil beneath or float with tides and currents remaining viable for up to a year. This reproductive structure allows the red mangrove to be a colonizer. Their prop roots stabilize soil, provide shade and attachment places for a variety of organisms and absorb energy from fierce Florida storms.

Materials Required



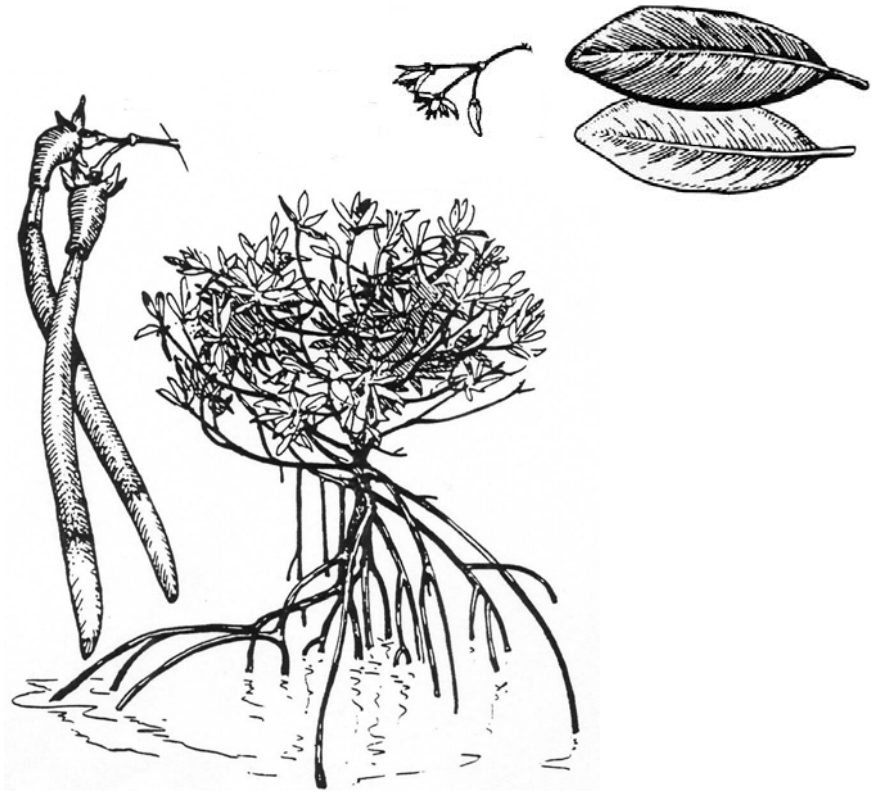
- 5 gallon bucket
- gallon of sand
- gallon of water
- tape
- *propagules
- salt shaker
- wax paper
- two broom handles
- egg
- branches of mangrove leaves or pictures of mangrove leaves
- pictures of crabs and small fish

Procedure

1. Review the background information provided for teachers.
2. Choose a volunteer student willing to be dressed as a red mangrove.
3. Have the student volunteer place one foot in the bucket to simulate high/low tide and the fact that red mangroves are sometimes in the water, sometimes they are out of the water.
4. Choose two students to sprinkle salt into the bucket as you discuss salinity levels and the fact that red mangroves live where fresh and salt water mix.
5. Choose two students to give the volunteer the mangrove leaves to hold. Remind students that trees capture energy from the sun and through photosynthesis convert energy to matter, thereby beginning the food chain.
6. Ask another student to tape wax paper on the arms of the student/mangrove to simulate the waxy surface of mangroves leaves and discuss how this waxy coating is an important adaptation for mangroves.

7. Choose another two students to use the broom handles to prop up the arms of the volunteer as you describe how the prop roots provide anchoring for the tree and for many forms of plants and animals.
8. Have several students add the pictures of fish and crabs to the bucket and discuss the role red mangroves play in providing important habitat to a variety of species.
9. Select one student to give the mangrove volunteer the propagules then ask the mangrove to release them while you describe seedling dispersal.
10. Give the volunteer the egg to hold to simulate the important role of red mangroves for bird nesting.
11. Tell students they will learn much more detail about red mangroves and the other species of mangroves during the next several class sessions and ask them to remember how unique and special the red mangrove is.

*Mangrove propagules are not protected; however, collection policies of public parks vary and should be consulted prior to taking any plant materials.



Mangrove Types

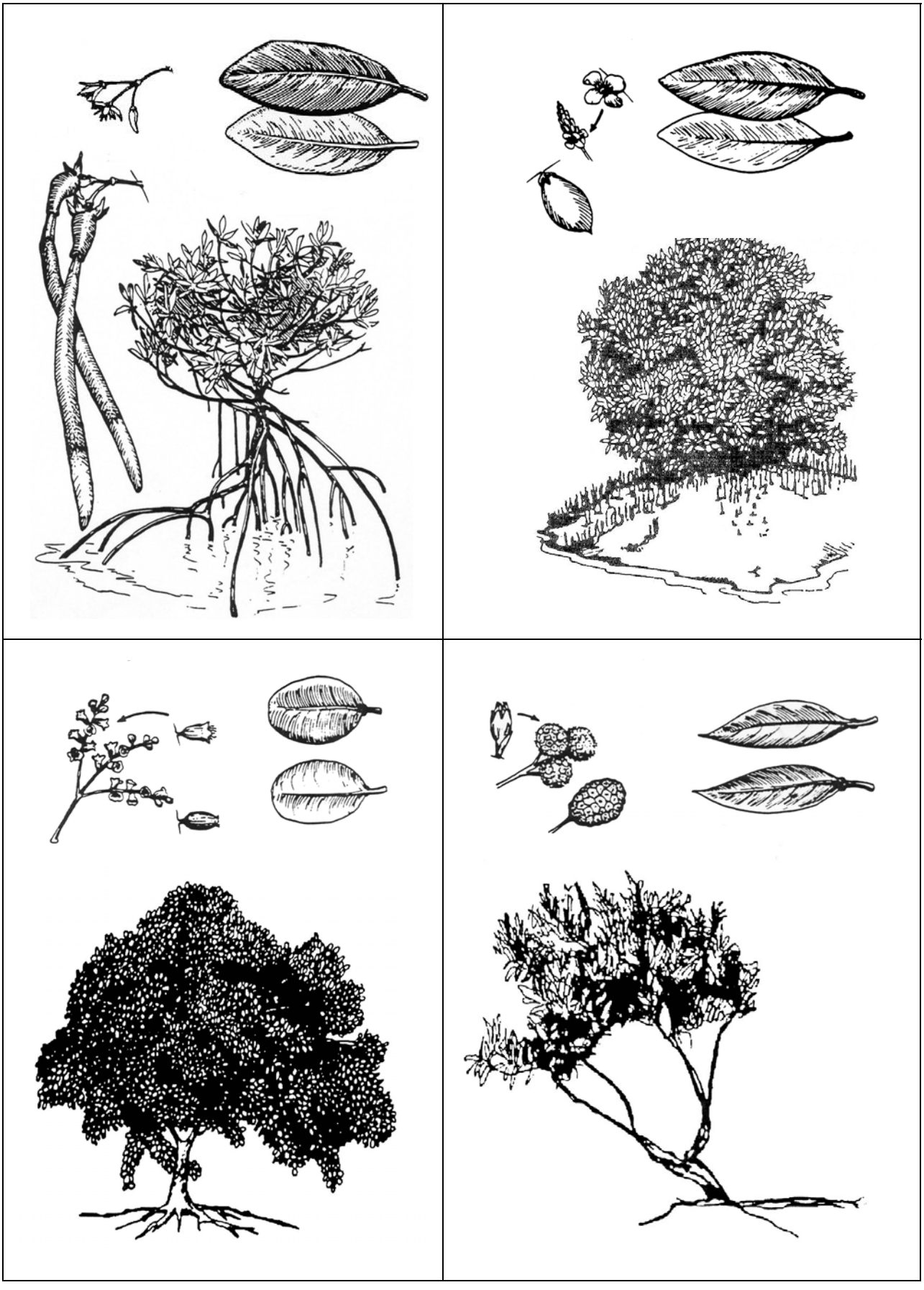
In this activity students will learn the differences between the mangrove types found in south Florida estuaries.

Materials

- Overhead transparency of mangroves made from page 20.
- One copy for each student of mangrove drawings with concept frame (page 23)
- Overhead transparency of student frame (page 23)

Procedure

1. Make an overhead transparency of pages 20, 21 and 23. This shows drawings of the mangrove types found in southwest Florida, the red, black and white mangroves and the buttonwood or button mangrove. The names of the trees are not included on this drawing. If technology allows, use projected digital photographs of mangroves at www.floridadep.org/coastal/habitats/mangroves.
2. Distribute to students a copy of page 23.
3. Read descriptions of mangrove species, found on page 21 and 22, one at a time, to the students.
4. As you finish each description ask the students which picture represents the tree you described.
5. Write the name of the mangrove tree next to the picture on the overhead (or display a new picture showing the name) and tell students to write the name of the mangrove in the appropriate place on their page.
6. Next, have the students complete their concept frame as you once again read the descriptions and showing the labeled drawing to assist.
7. Have students write a summary of information about the four mangrove trees on the bottom of the page, using their drawings, concept frames and information learned previously.



Mangroves

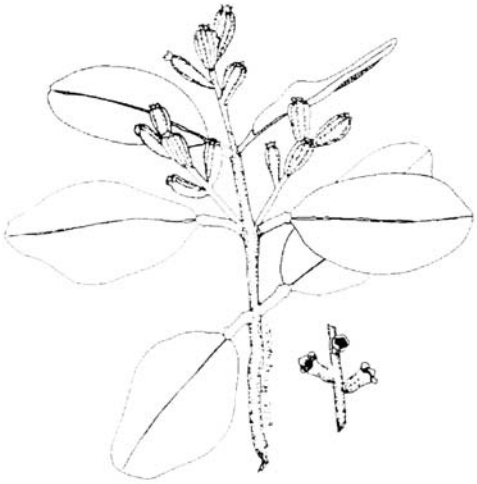
Mangroves provide the basic food source for one of the most ecologically productive habitats in the world – the ESTUARY.

Red mangrove *(Rhizophora mangle)*

- grows along the water's edge
- has thick, green waxy leaves
- protects / stabilizes soil
- seedlings develop on the tree
- roots filter out salt
- provides habitat for wildlife
- acts as a storm buffer
- rotting leaves (detritus) provides food source
- filters salt at roots

Black Mangrove *(Avicennia germinans)*

- grows behind red mangroves in areas flooded by highest tides
- two tone leaf color, green on top, grey underneath
- seeds germinate on tree
- excretes salt through leaves
- vertical branches of root system (pneumatophores) stick out of soil, used for respiration

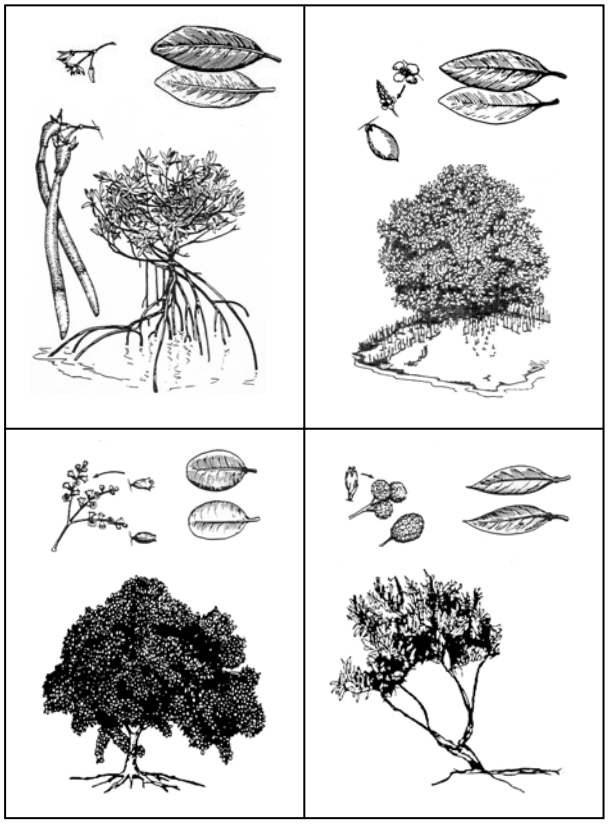


White Mangrove *(Laguncularia racemosa)*

- has thick, leathery elliptical leaves
- grows behind black mangroves in areas less often flooded by high tides
- no visible aerial roots
- leaves are notched at top
- have two sugar glands at base of leaf
- excrete salt through leaves

Buttonwood *(Conocarpus erecta)*

- found in ecotone between marine mangrove habitat and inland freshwater habitat
- bark of mature trees very uneven and rough
- has many epiphytes (plants that grow on trees – air plants, ferns, orchids)
- its wood is used to smoke fish
- has glands on leaf stalk



Name of Mangrove	Shape of Leaf	Salt	Seedlings	Special Features

Summary paragraph (2-3 sentences):

Build A Mangrove Community

This activity can take place throughout the unit or near the end of the learning sequence.

Procedure

1. Many activities exist for developing classroom displays or murals for various habitat types. The next two pages are from *Ranger Rick's Nature Scope*, *Wading into Wetlands* that was first published in 1989.
2. Also provided is an illustration of a Mangrove Community from the publication *The Seaside Naturalist* by Deborah A. Coulombe, 1992 to assist you and your students in placing specific animals and plants.
3. Review the suggestions, gather supplies and encourage the creativity of your students.
4. Enhance the display by having students include facts about their mangrove community in their display so that a visitor to their forest could learn about the inhabitants. The "information cards" about animals and plants of mangrove communities found in the resources section and previous activities in this unit can assist with this task.

Build a Mangrove

Build a life-sized model of a mangrove tree.

Objective:
Name some of the animals that live in a mangrove swamp and describe how they use mangrove trees.

Ages:
Intermediate and Advanced

Materials:
- *copies of page 31*
- *construction paper*
- *glue*
- *scissors*
- *egg cartons (optional)*
- *pipe cleaners (optional)*
- *green and blue tissue paper*
- *tape or stapler*
- *stepladder (optional)*
- *thin cardboard*
- *crayons or markers*

Subjects:
Science and Art

Clear a corner of your classroom or meeting area and make way for a mangrove to take root! First give each child a copy of page 31. Explain that this mangrove swamp scene shows some of the animals that live in mangrove trees. You can use the background information on page 23 to talk about these animals.

Then tell the kids that they'll be working together in groups to make a red mangrove tree complete with roots, branches, leaves, and wildlife. Divide the kids into three teams—the Trunk Team, the Root Team, and the Canopy Team. Directions on how to make the three parts of the tree are listed below. We've also included a short section on page 26 about how to make some of the animals that live on and around mangrove trees. (Have the kids look at their mangrove scenes to decide where the animals should go. Also see "Trees that Walk," *Ranger Rick*, Nov. 1986, pp 38-46, for more about mangrove swamps.) Then bring out construction paper, glue, scissors, tissue paper, egg cartons, and pipe cleaners, and watch that mangrove grow!

TRUNK

1. Tape or staple several sheets of brown or black construction paper together to form a trunk about one foot (30 cm) wide and three feet (90 cm) long.
2. Tape the trunk in the corner, attaching the sides of the trunk to the two walls. (This will give the effect of a three-dimensional tree.) The base of the trunk should be about two feet (60 cm) above the floor (see diagram on next page).
3. Create water around the mangrove by taping several sheets of blue tissue paper to the wall. The "sea" should reach from the floor to the base of the trunk.

ROOTS

1. Cut black or brown construction paper into long strips about 1 inch (2.5 cm) wide and 2-3 feet (60-90 cm) long. Also cut some shorter strips to make "accessory" roots that branch off the longer ones.
2. Beginning at the bottom of the trunk, tape the strips end to end to form roots reaching along both walls and extending away from the corner into the "water" (see diagram on next page). Anchor the roots by taping them to the floor.
3. Tape more strips along the main roots to make a maze of roots. Keep attaching more strips until the tangle of roots reaches into the water and a bit higher than the base of the trunk.

BRANCHES AND LEAVES (CANOPY)

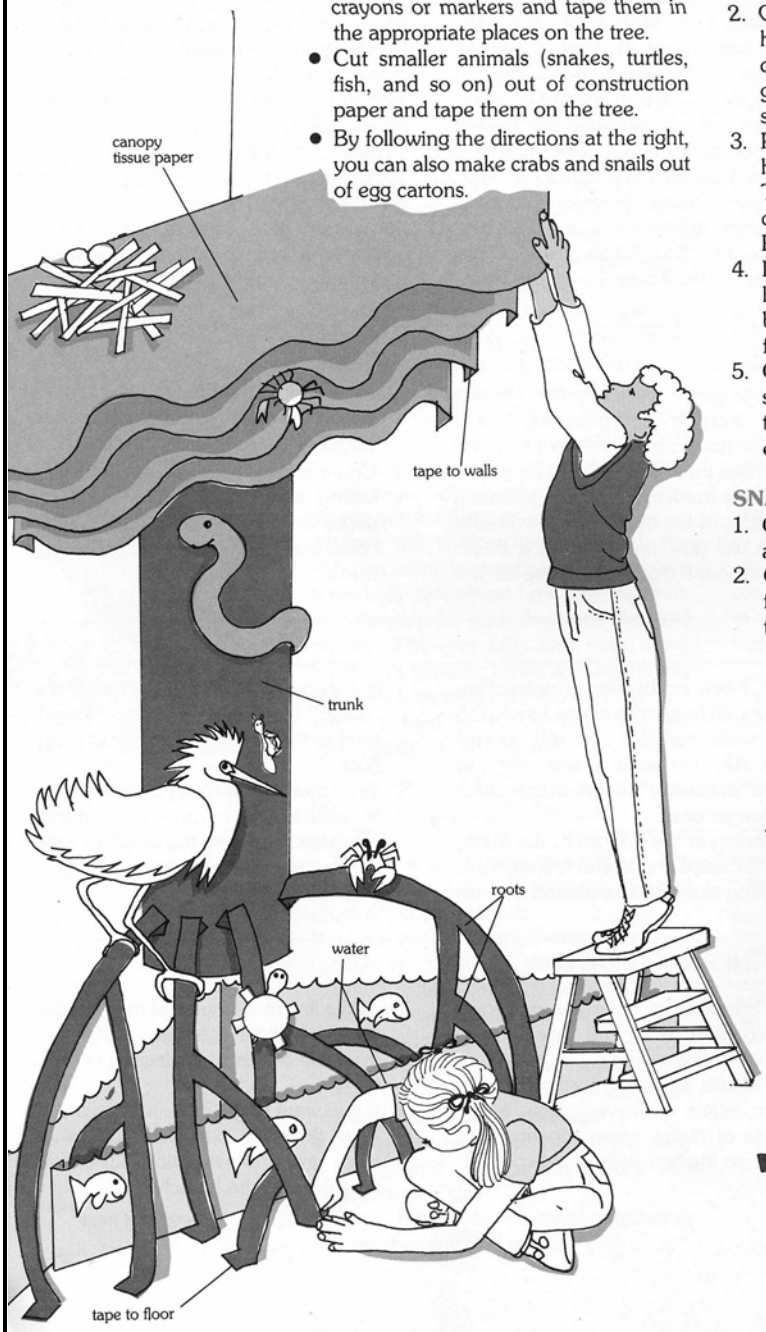
1. Cut branches out of black or brown construction paper and tape them to the top of the trunk.
2. Use sheets of green tissue paper to make layers of leaves. Tape a few sheets of tissue paper together and attach to the two walls of the corner.
3. Add a few more layers of tissue paper, each one a little higher and a bit farther from the corner (see diagram on next page).
4. If you want to get more kids involved, have them cut out individual leaves from green construction paper and tape them to the branches.

(continued next page)

From Ranger Rick's Nature Scope, Wading Into Wetlands, 1989

MANGROVE ANIMALS

- For larger animals such as herons, pelicans, and crocodiles, cut outlines out of thin cardboard. Color them with crayons or markers and tape them in the appropriate places on the tree.
- Cut smaller animals (snakes, turtles, fish, and so on) out of construction paper and tape them on the tree.
- By following the directions at the right, you can also make crabs and snails out of egg cartons.

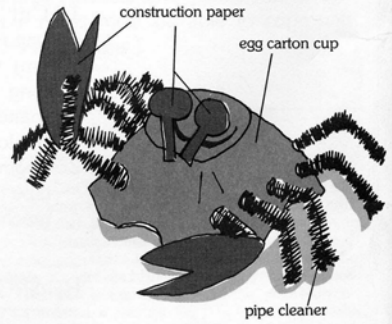


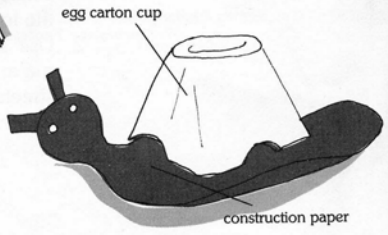
CRAB

1. Cut out one cup from the egg carton and turn it upside down.
2. On each side of the cup, poke four holes in a line about a half-inch (1.3 cm) above the bottom edge (see diagram). Also poke two holes in the front section of the cup.
3. Poke one pipe cleaner through a side hole and out the hole on the other side. Then bend the pipe cleaner ends downward to form the legs of the crab. Repeat with three other pipe cleaners.
4. Push a fifth pipe cleaner through the holes on the front of the crab, and bend the ends forward. These will form the clawed legs.
5. Cut claws and stalked eyes out of construction paper. Glue the eyes on the top of the cup and the claws on the ends of the pipe cleaner (see diagram).

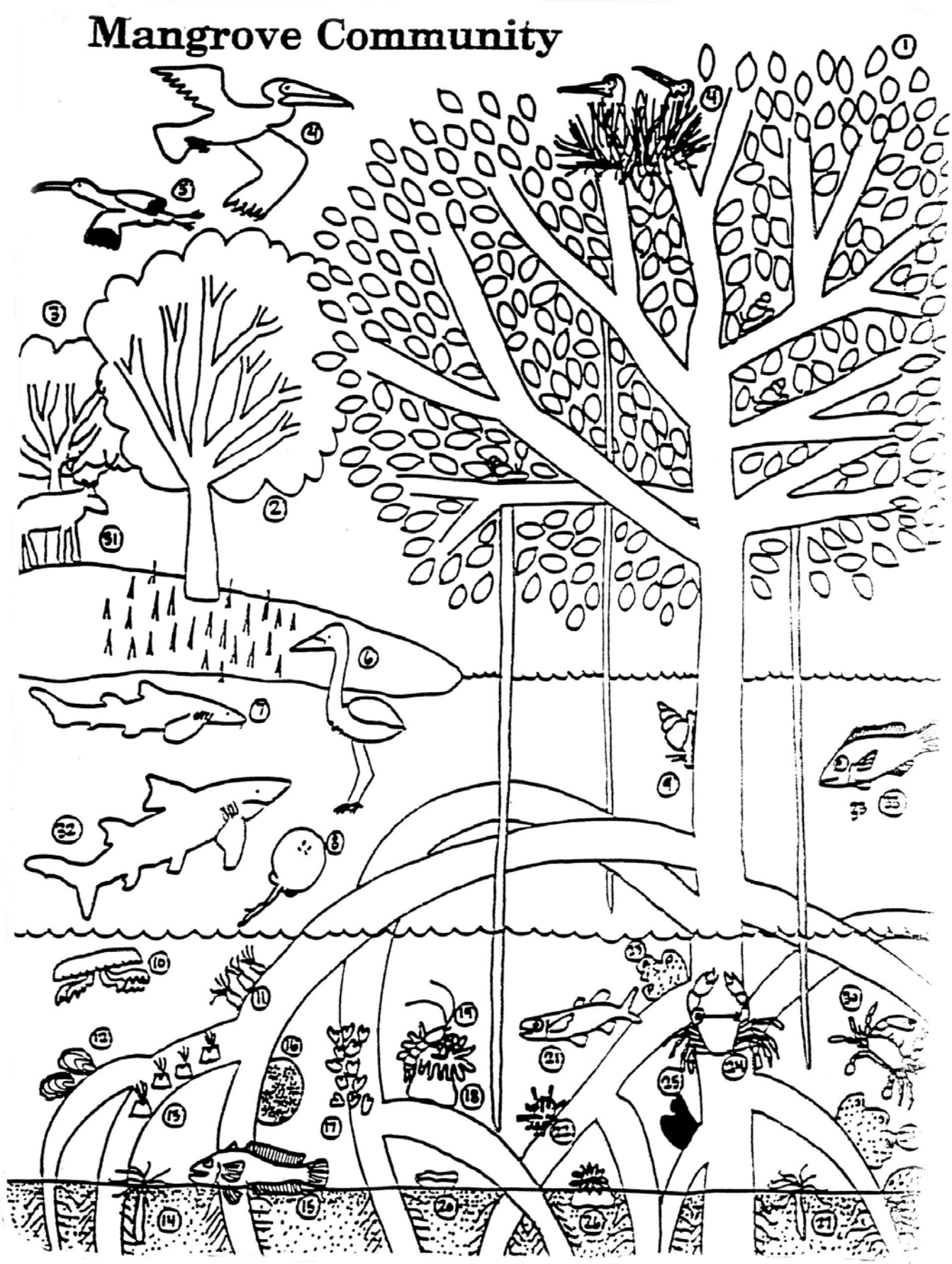
SNAIL

1. Cut out one cup from an egg carton and turn it upside down.
2. Cut out a foot, head, and tentacles from construction paper and glue them to the cup (see diagram).





Mangrove Community



Growing Mangroves: Effects of Salinity on Mangrove Plants

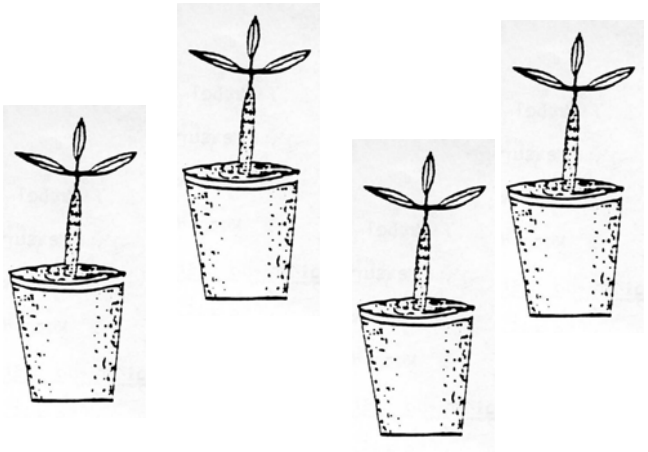
Students will compare the growth of mangrove seedlings immersed in water of four different salinities.

Background

Mangroves are halophytes (salt-tolerant species). They will sprout and grow effectively in containers with water only and in water with varied salt concentrations.

Materials

- A variety of red mangrove seedlings
- Instant ocean
- Water
- Four plastic containers per student group
- Hydrometer
- Metric rulers



Procedure

1. Divide students into groups.
2. Review salinity. Demonstrate how to use a hydrometer and have students practice on several solutions.
3. Give each group four plastic containers.
4. Have students mark each cup. Mark one with 0 ppt, mark one with 20 ppt, one with 40 ppt and one with 60 ppt.
5. Give each student enough instant ocean to mix solutions of the three different salinities (20, 40 and 60 ppt) by following the directions on the instant ocean. Have them verify their concentrations using the hydrometer.
6. Have the students mark their containers with the four different salinity concentrations.
7. Have the students mark each container with a water line, the line to which they will fill their cup initially and to which they will re-fill their cup on a daily basis.
8. Give each group 4 mangrove propagules.
9. Work with the students to create a data chart in their notebooks to record their data.
10. Brainstorm with the students and develop a hypothesis about the propagules.
11. Have the groups measure their propagules and record the length.
12. Have the students count the number of leaves, if any.
13. Have the groups place one propagule in each container.

14. Tell students to carefully measure the height of each propagule above the container rim.
15. Each day have students fill their containers with the appropriate amount of water and take measurements on increased growth in height and number of leaves, if any.
16. Periodically, discuss the results with the students. Remind students that mangroves can be slow growing. Also discuss the importance of replicating data and compare the data across many groups. Ask students what variables there might be that will effect the results.
17. Record any questions that arise on the list that was begun during the semantic mapping and allow time to discover information about those questions.
18. Once the propagules are growing well and your data collection is over, pot the seedlings with soil in pots decorated by the students. Then, have the students give the potted tress as gifts. Alternatively, locate an agency or group in your area that can use them in restoration efforts.